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Seed priming with brassinolides enhances growth and strengthens antioxidative defences under normal and heat stress conditions in *Brassica juncea*

Background:

Environmental stresses pose a major challenge to meet increasing food demand. Researchers are trying to generate high-yielding and stress-tolerant or resistant varieties using classical genetics and modern gene-editing tools; however, both approaches have limitations. Chemical treatments emerged as an alternative to improve yield and impart stress resilience. Brassinosteroids (BRs) are a group of phytohormones that regulate various biological processes, including stress management.

Objective:

We hypothesize that priming of seeds, which requires lesser amounts of BRs, could be equally effective in promoting growth and stress tolerance. Owing to this notion, we analysed the impact of priming seeds with selected BRs, namely, 24-epibrassinolide (EBL) and 28-homobrassinolide (HBL), in *Brassica juncea* under normal and heat shock stress conditions.

Methods:

Seeds primed with BRs and grown until seedlings stage at normal conditions (20°C) were subjected to a heat shock (35°C) for a few hours, relating to what plants experience in natural conditions and then harvested for analyses. The experiment was established in a randomized block design with three replicates. For field data, both unstressed and heat-shocked seedlings (10 seedlings per group) were transferred to fields in randomized plots until maturity. Different physiological, biochemical and molecular attributes were analysed.

Results:

Increased photosynthetic performance upon EBL and HBL treatments have been shown to protect plants from the detrimental effects of stress mainly by promoting the accumulation of antioxidants, including carotenoids, proline, and increased expression of various antioxidant enzymes and enhancing growth-related genes. Heat shock reduced the growth and biomass with an increased accumulation of reactive oxygen species. As anticipated, BRs treatments significantly improved the growth and physiological parameters with an enhanced antioxidant defence under both conditions (Neha et al., 2022). Transcriptional analyses revealed that BRs concomitantly induce growth and oxidative stress-responsive gene expression via the canonical BR-signalling pathway. Transfer of unstressed and heat-shock-treated seedlings to field conditions demonstrated the long-term effectivity of BR-priming.

Conclusions:

Our results clearly indicated that priming of seeds with BRs is economical and shows a similar effect on growth as well as stress responses compared with spray methods requiring large amounts of these hormones. Seed priming with BRs could improve growth and resilience against heat shock; hence, it appears to be a viable strategy to enhance crop yields and stress tolerance. The efficiency of seed priming with BRs could be tested in the future with other stresses to strengthen the findings and economic viability of this method.

Reference:

Neha, Twinkle, Sumanta Mohapatra, Geetika Sirhindi and Vivek Dogra. (2022) Seed priming with brassinolides improves growth and reinforces antioxidative defenses under normal and heat stress conditions in seedlings of *Brassica juncea*. *Physiologia Plantarum* 174, e13814.